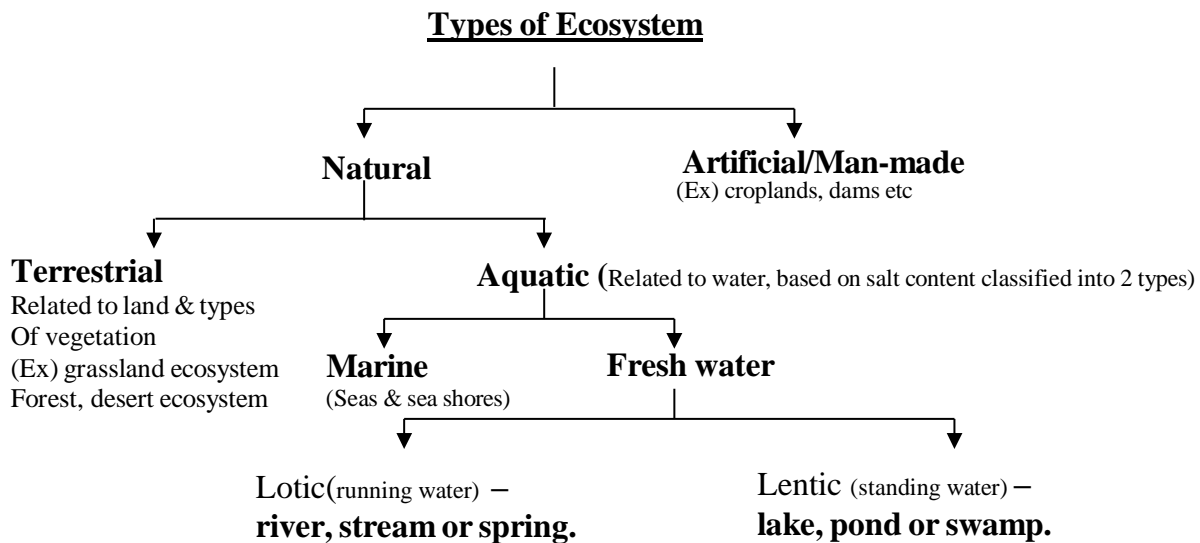


CHAPTER 1

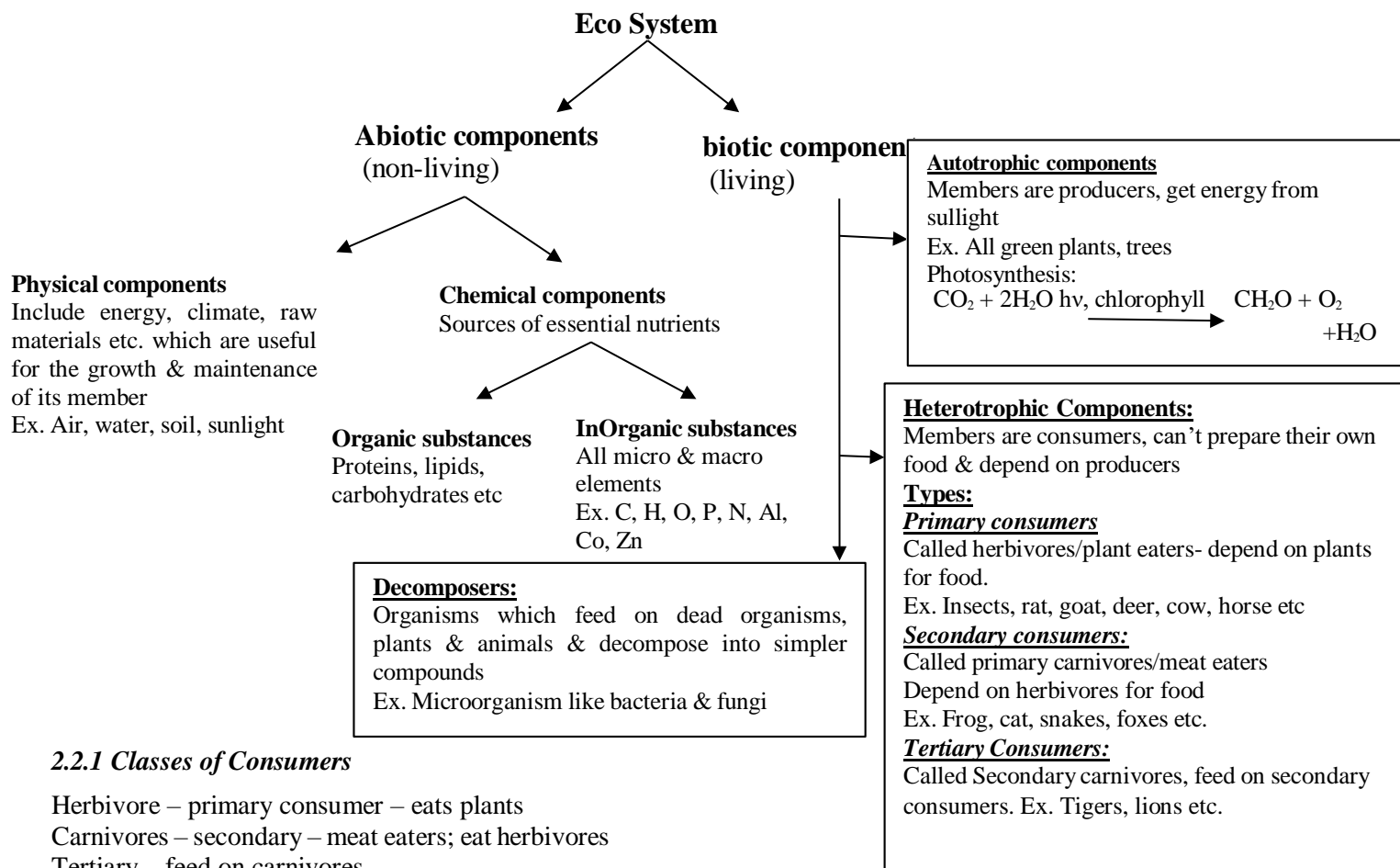
ECOSYSTEMS AND BIODIVERSITY

Ecosystem—A group of organisms interacting among themselves and with environment is known as ecosystem.



Ecology - Study of interactions among organisms, with their environment. the flows of energy and materials between abiotic and biotic components of ecosystems.

Structure/ Components of an Ecosystem:



2.2.1 Classes of Consumers

- Herbivore – primary consumer – eats plants
- Carnivores – secondary – meat eaters; eat herbivores
- Tertiary – feed on carnivores
- Omnivores – eat plants/animals.

Energy flow through atmosphere to an ecosystem:

Sun the ultimate source of energy is absorbed by producers (plants) to produce organic matter through photosynthesis. The conversion of solar energy is governed by law of thermodynamics.

1st Law of Thermodynamics:

Energy can neither be created, nor be destroyed, but it can be converted from one form to another

(Ex) photosynthesis- solar energy converted to chemical energy.

Photosynthesis Equation: $\text{CO}_2 + 2\text{H}_2\text{O} \xrightarrow{\text{hv, sunlight}} \text{CH}_2\text{O} + \text{O}_2 + \text{H}_2\text{O}$

Plants are used by herbivores, herbivores are used by carnivores as their food.

Thus energy is transferred & conversion of solar energy is governed by law of thermodynamics

2nd law of thermodynamics:

Whenever energy is transformed, there is a loss of energy through the release of energy in the form of heat.

(Ex). Respiration process: $\text{CH}_2\text{O} + \text{O}_2 \longrightarrow \text{CO}_2 + 2\text{H}_2\text{O}$

Relationship between structure & function:

Hence biotic components and abiotic components are linked through energy flow and nutrient cycle.

Sun → Plants → Animals → Bacteria

FOREST ECOSYSTEM

Introduction: A forest ecosystem is the one in which a tall & dense trees grow which support many animals & birds. In India 19% occupies forest of total land area.

Types of Forest ecosystem:

Tropical rain forests → found near the equator, high temperature, have broad leaf trees like sandal, lion, tiger

Tropical deciduous forest → Found away from equator, warm climate, deciduous trees like maple, oak, deer, fox, rabbit etc.

Temperate rain forests → adequate rainfall areas, coniferous trees like pines, firs, squirrels, fox, cats, bear etc.

Temperate deciduous forest → found in moderate temp., trees like oak, hickory, animals – deer, fox, bear etc.

Tropical scrub forests → dry climate for longer time, small deciduous trees & shrubs, animals – deer, fox etc.

Characteristics of forest ecosystem:

- Characterized by warm temperature, adequate rainfall
- Maintain climate & rainfall
- Support many wild animals & protect biodiversity
- Soil is rich in minerals, so support growth of trees
- Penetration of light is poor so conversion of organic matter is very fast

Structure and Function of Forest Ecosystem

I. Abiotic Components → abiotic components are physical components present in soil & atmosphere
(Ex) temperature, light, rainfall, minerals

II. Biotic Components

1. Producers → plants absorb sunlight & produce food by photosynthesis. Ex-trees, shrubs, plants
2. Consumers

Primary consumers → Called herbivores/plant eaters- depend on plants for food. Ex. Insects, rat, goat, deer, cow, horse etc

Secondary consumers → Called primary carnivores/meat eaters. Depend on herbivores for food Ex. Frog, birds, cat, snakes, foxes etc.

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Tertiary consumers → Called Secondary carnivores, feed on secondary consumers. Ex. Tigers, lions etc.

3. **Decomposers** → *Organisms which feed on dead organisms, plants & animals & decompose into simpler compounds Ex. bacteria & fungi*

GRASSLAND ECOSYSTEM

Introduction: Occupies 20% of earth's surface. Grass species, shrubs, trees are present.

Types: Tropical grassland → *High temperature, moderate rainfall, known as Savanna-type, zebra, giraffe*

Temperate grassland → *found in centers of continents, very cold winters, hot summers, summer fires, no trees or shrubs*

Polar grassland → *severe cold, strong wind with ice & snow. Animals -Arctic wolf, fox, small plants grow.*

Structure and functions of Grassland Ecosystems

Same as forest ecosystem

AQUATIC ECOSYSTEMS

Introduction: Aquatic ecosystem deals with water bodies.

Types: 1. Fresh water life zones → (ex) Ponds, streams, lakes, rivers

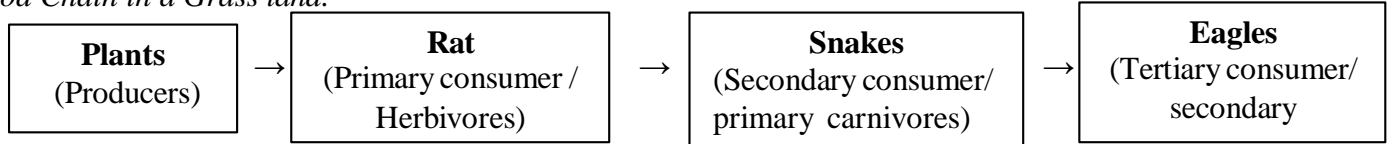
2. Salt water life zones → (ex) oceans, estuaries

FOOD CHAIN

Definition : The sequence of eating & being eaten in an ecosystem is food chain (or)

Transfer of food energy from the plants through a series of organisms is food chain.

1. *Food Chain in a Grass land:*



2. *Food Chain in a Pond:* Phytoplankton → Zooplankton → Small fish → large fish → Man

3. *Food Chain in a forest:* Plants → Deer → Tigers/Lions

Types of Food Chain: *Grazing Food Chain* → starts with green plants & goes to decomposer food chain/
Detritus food chain → starts with dead organic matter & goes to decomposer food chain.

Tropic Levels:

The various steps through which food energy passes in an ecosystem is called as tropic level.

$T_1 \rightarrow T_2 \rightarrow T_3 \rightarrow T_4 \rightarrow T_5$

T_1 = Producers, T_2 = Primary consumers, T_3 = Secondary consumers, T_4 = Tertiary consumers, T_5 = decomposers

FOOD WEB

Definition: The interlocking pattern of various food chains in an ecosystem is food web. Many food chains are interconnected.

Energy Flow in Food web:

- Grass → insects → fishes → birds → tigers
- Grass → insects → birds → tigers
- Grass → deer → tigers
- Grass → insects → birds → tigers

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- Grass → cattles → tigers
- Grass → rats → snakes → eagles → tigers
- Grass → rats → eagles → tigers

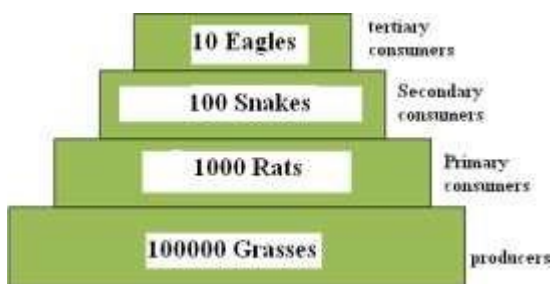
Difference between food chain & food web: In food chain, if one species gets affected, then species in all trophic levels are also affected. But in food web if one species gets affected, it does not affect other trophic levels.

ECOLOGICAL PYRAMIDS

Graphical representation of structure and function of trophic levels of an ecosystem is ecological pyramid.

Types:

Pyramid of Numbers → Represents the number of energy individual organisms present in each trophic levels.



Producer – occupy 1st trophic level

Primary consumer occupy 2nd trophic level

Bcoz no of rats are lower than no of grasses.

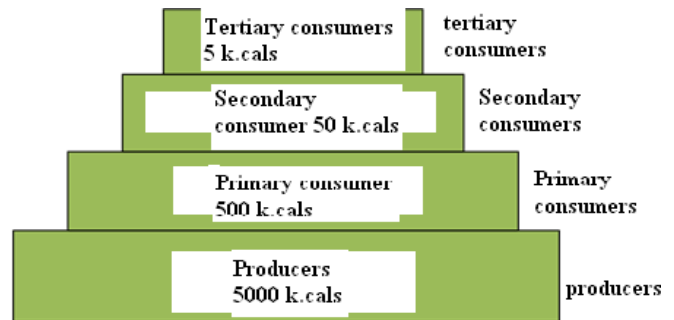
Secondary consumer occupy 3rd trophic level

Bcoz no of snakes are lower than no of rats

Tertiary consumer occupy 4th trophic level

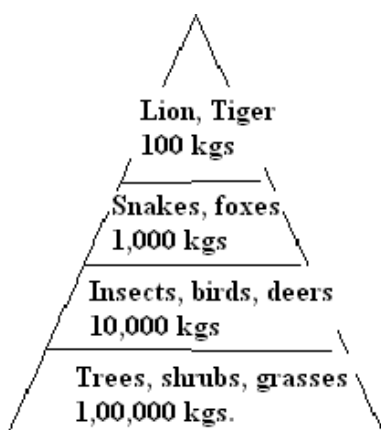
No & size is very low.

Pyramid of Energy: Represents the amount of energy present in each trophic level.



- * At each trophic level there is a heavy loss of energy
- * Hence there is a sharp decrease in energy at all level

2.10.2 Pyramid of Biomass → The amount of living or organic matter present in a particular environment is called biomass. – There is a decrease in the biomass from the lower trophic level to the higher trophic level.



ECOLOGICAL SUCCESSION

The progressive replacement of one community by another till the development of stable community in a particular area is ecological succession.

Stages of ecological succession:

Process of Ecological Succession

Nudation

Invasion → Migration, Establishment

Competition

Reaction

Stabilization

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Pioneer community → first group of organism in an area

Seral stage → various developmental stages of community

Types of ecological succession:

Primary succession → involves gradual establishment of biotic communities on a lifeless ground

Hudrarch / Hydrosere → establishment starts in watery area like pond and lake

Xerarch / Xerosere → establishment starts in a dry area like desert and rock

Secondary succession → Involves establishment of biotic communities in an area, where biotic community already present there.

BIODIVERSITY

Definition: The variety and variability among all groups of living organisms and the ecosystem in which they occur.

Levels/Classification of Biodiversity:

- 1) Genetic diversity** → Diversity within the species is genetic diversity. (ex) teak wood varieties, Indian, Burma, malasian
- 2) Species diversity** → diversity between different species. (ex) plant species = apple, mango, grapes, animal species = lion, tiger, elephant etc.
- 3) Community/Ecosystem diversity** → Diversity at the ecological or habitat level is ecosystem diversity. Ex. River ecosystem.

VALUES OF BIODIVERSITY

1. Consumptive use:

Drugs: Many plants are used in primary health care.

70% of modern medicines are derived from plant and plant extracts.

(Ex) Penicillin – fungus is the source – Antibiotic

Quinine – Chincona bark - Malaria treatment

Morphine – Poppy bark – Analgesic

Fuels: Fire woods are directly consumed by villagers.

Food: A large number of wild plants and wild animals are consumed by human beings as food.

2. Productive use:

Biodiversity products have commercial value.

These products are marketed and sold. These are derived from animals and plants.

Animal products: Silk from silk worm

Wool from sheep

Musk from musk deer

Leather from animals

Plant Products: Wood for paper and Plywood

Cotton for textile industry

Pearl for pearl industry

3. Social value:

*It refers to the manner in which the bio-resources are used in the society.

*These are associated with the social life, religion and spiritual aspects of the people.

e.g., Holy plants: Tulsi, Lotus, Neem trees

Holy animals: Cow, snake, bull, peacock

4. Ethical value:

It means that a species may or may not be used but its existence in nature gives us pleasure.

e.g., Holy river: River Ganga

Holy tree: Tulsi, Vengai

5. Aesthetic value:

The beautiful nature of plants and animals insists us to protect the biodiversity. Ex) eco-tourism, colour of butterfly, flowers etc.

6. Optional value:

The optional value of biodiversity suggests that any species may be proved to be a valuable species after someday.

HOT- SPOTS OF BIODIVERSITY

The hot spots are the geographic areas which possess high endemic species.

An area is designated as a hot spot when it contains at least 0.5% of plant species as endemic.

Area of hot spot: There are 25 Hotspots of biodiversity worldwide. Out of which 2 are present in India.

Eastern Himalayas → Nepal, Bhutan, Indo-Burma region, 30% of endemic species

Western Ghats → Sri Lanka region, ex – Maharashtra, Karnataka, Tamil Nadu, Kerala. 1500 endemic species.

Plants → *Ternstroemia japonica*, *HYPERICUM*.

Animals → Blue bird, lizard, hawk

THREATS TO BIODIVERSITY

Any disturbance in a natural ecosystem tends to reduce its biodiversity. Various threats to biodiversity are:

HABITAT LOSS: Loss of population of interbreeding organism.

Factors influencing Habitat Loss:

Deforestation:

- Forest & grasslands are cleared for agricultural lands or developmental projects.
- Many species disintegrate due to loss of natural habitat.

Destruction of wetlands:

- Wetlands are destroyed due to pollution, draining etc.

Developmental activities:

- Construction of dams in forest, industrial effluents kill birds & aquatic organisms.

Habitat fragmentation:

- Habitat is divided into small & scattered
- So, many animal & birds are vanishing.

Raw materials:

- For the production of hybrid seeds, wild plants are used as raw materials.

Production of Drugs:

- Pharmaceutical companies collect wild plants for drugs production.
- So, no of medicinal plants are on the verge of extinction.

Illegal Trade:

- Trade on wild life reduces bio-diversity

2. MAN-WILDLIFE CONFLICTS:

Examples:

Sambalpur – orissa:

195 humans were killed by elephants, In retaliation- 98 elephants were killed, 30 injured by villagers.

Kote – Chamrajanagar –Mysore:

Sugarcane & cotton crop, explosives

Royal Chitwan National Park – Kathmandu

Man-eating tiger killed 16 nepalese, 4 yrs chil

Sanjay Gandhi National Park – Mumbai

Leopards killed– 14 persons

POACHING:

Killing / Hunting of animals is poaching.

Types:

Subsistence Poaching- killing animals for surviving.

Commercial Poaching- hunting animals for selling

Factors influencing Poaching:

Human Population: increase in population increases pressure on forest resources.

Commercial activities: Smuggling of wild life products for high profit.

Wildlife products=Furs, horns, tusk, live specimen, herbal products.

Importers of wild life = Europe, North America, Japan, Taiwan, Hong Kong

Examples:

- Male gorilla for its body parts
- Blue morpho butterfly – making attractive trays
- Snowy large egret – used for white feather in ladies hat.US
- Elephant feet – for making Ash trays
- Elephant – for ivory
- Bengal tiger – soled for \$1,00,000 in foreign market
- Dynamite fishing – high tech fishing, exhaust marine life. Sea horses, Sea turtles

Factors Influencing man-animal conflicts:

1. Shrinking of forest compels wildlife to move outside the forest
2. Electric wiring around crops
3. Animals suffer pain and attack humans
4. Female wildlife attack human more to safe its cubs.
5. Forest dept. don't cultivate foods for wild
6. Cash compenstn by Govt – 400/- per quintal
But market price 2400/-
7. Garbage near human settlement attract wild

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Remedial Measures for conservation of biodiversity:

Make Available of Adequate food & water for wildlife Construction works in forest must be stopped. Solar powered fencing must be used to prevent animals

ENDANGERED & ENDEMIC SPECIES OF INDIA:

Species are classified into various types:

Extinct species → No longer found in the world

Endangered species → A species is said to be endangered when its no has been reduced to a critical level. Unless it is protected it is in danger of extinction.

Vulnerable species → when its population is facing continuous decline due to habitat loss.

Rare species → when it is localized within restricted area.

ENDANGERED SPECIES OF INDIA:

A species is said to be endangered when its no has been reduced to a critical level. Unless it is protected it is in danger of extinction

No of threatened species of India:

Plants	250
Birds	70
Mammals	86
Reptiles	25
Amphibians	3
Fishes	3
Molluscs	2, Insects -50

Important Endangered Species:

Reptiles → Tortoise, green sea turtle, gharial, python
Birds → Peacock, Siberian white crane, pelican, Indian Bustard
Mammals → Indian wolf, red fox, tiger, Indian lion, golden cat, desert cat.
Primates → lion tailed monkey, capped monkey, golden monkey
Plants → medicinal plants, sandal wood tree

RED-data Book = Data book which contains the list of endangered species of plants and animals.

Factors affecting Endangered Species:

- **Pollution:** Human disposal in nature. Travel through food chain and leads to death
- **Over-exploitation:** over usage of natural resources & poaching leads to extinct of wild life
- **Climate change:** ozone depletion, flood etc, threatens organisms and ecosystem

Remedial Measures:

- CITES – Convention on International Trade in Endangered Species is signed
- 2900 and other 900 endangered species are restricted for trade.

ENDEMIC SPECIES:

- The species, which are found only in a particular region are known as endemic species.
- 62% of endemic species are found in Himalayas and Western Ghats

Fauna:

- Animals present in a particular region or period is Fauna.
- 62% amphibians & 50% lizards are endemic to Western Ghats.
- (ex) Monitor lizards, reticulated python, Indian salamander, viviparous toad.

Flora:

- Plants present in a particular region or period is Flora
- (ex) Sapria himalayana, ovaria lurida, pteridophyta, angiosperms etc.

Factors affecting endemic species:

Habitat loss, fragmentation, pollution

CONSERVATION OF BIODIVERSITY

Definition : The management of biosphere for the sustainable benefit to meet the needs of future generation.

Factors affecting biodiversity:

- Human activities like construction of dams in forest, industrial wastes, using pesticides etc
- Poaching of wild animals, over exploitation of natural resources.
- Discharge of effluents disturbs the marine ecosystem
- The climatic factors-global warming, ozone depletion, acid rain affect the biodiversity

Advantages or Need of Biodiversity:

- Recreation, tourism, Drugs, herbs, food, important raw materials, preserves plants & animals, hence leads to life supporting systems.

Types of Biodiversity:

- In-situ conservation (within habitat)
- Ex-situ conservation (outside habitat)

Methods of In-Situ conservation:

Biosphere reserves	– 7
National Parks	80
Willife sanctuaries	420
Gene sanctuaries	120

IN-SITU CONSERVATION:

Involves protection of fauna & flora within its natural habitat.

1. Biosphere Reserves:

- Covers area of more than 5000 sq. km.
- Protect species for long time

<u>(ex)</u> Nanda devi	U.P
Nokrek	Meghalaya
Nilgiri	Kerala, TN, Karnataka
Manas	Assam
Sunderbans	West Bengal
Gulf of Mannar	TN

Role of Biosphere reserves:

- Protects endangered species
- Site of recreation & tourism
- Useful for education & research purpose
- Gives long term survival

Restriction:

No tourism & explosives are permitted.

3. Wildlife Sanctuaries:

- Conserve animals & Birds only

(examples)

Mudumalai wildlife sanctuary	–TN
Vedanthangal Bird sanctuary	- TN
Sultanpur Bird sanctuary	- Haryana
Ghana Bird sanctuary	- Rajasthan
Wild Ass sanctuary	-Gurajat

Role of wildlife Sanctuaries:

Protects animals only
Harvesting of timber,

Collection of forest products

2. National Park:

- Covers area of about 100 to 500 sq.kms
- Conserves wildlife & environment

<u>(ex)</u> Gir National Park	Gujarat
Periyar	Kerala
Dudwa	UP
Sariska	Rajasthan
Ranthambore	Rajasthan
Kaziranga	Assam

Role of National Park:

- For tourism without affecting environment
- Protect, propagate & develop wild life

Restrictions:

4. Gene Sancturay:

- Conserve Plants

Examples:

Citrus sanctuary	– North India
Pitcher plant	-North India

5. Other Projects for conservation of animals:

Examples:

Gir Lion Project, Crocodile Breeding Project, Project Elephant, Project Tiger etc.

Merits of In-situ conservation:

Very cheap & convenient method
Species adjust to floods, drought, forest fires etc.

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Demerits

Large area is needed, Maintenance is not proper due to pollution and lack of staff.

Restrictions:

Killing, hunting, shooting of wildlife is prohibited

EX-SITU CONSERVATION:

Involves protection of fauna & flora outside the natural habitats.

Role of Ex-situ conservation:

Maintenance of endangered plant & animal species under controlled conditions

Preserves more important species

Methods of Ex-situ conservation:

1. NBPGR

National Bureau of Plant Genetic Resources → uses cryo technique

Cryo Technique: Preservation of seeds, vegetables, fruits, crops, etc by using liquid nitrogen at -196° C

2. NBAGR :

National Bureau of Animal Genetic Resources → preserves semen of bovine animals

3. NFPRCR:

National Facility for Plants Tissue Culture Repository → preserves crops or trees by tissue culture

Merits

Survival / life span of species increase by special care

Species are assured for food, water, shelter etc

Endangered species are preserved

Demerits:

Expensive method

Freedom of wildlife is lost

Animal can't survive in natural environment

Two Marks Questions:

1. **What is environment?** Ans: Sum of total of all the living & non-living things around us is environment.

2. **Define environmental studies?**

Study of the environment its biotic and abiotic components and their interrelationship is env. Studies.

3. **Explain Biosphere?**

Ans: The part of lithosphere, hydrosphere and atmosphere in which living organisms live & interact with one another is called biosphere.

4. **Define Producers?** Ans: Producers synthesize their food themselves through photosynthesis .ex all green plants.

5. What is ecological succession? Mention their types

6. What are food chain? Mention their types

7. What is food web?

8. **Name Four ecosystem?** Ans: Forest, Grassland, Desert, Pond ecosystem

9. Explain the concept of an ecosystem?

10. Define producers and consumers?

11. **How does a biome differ from an ecosystem?**

Ans: An ecosystem which is exposed to same climatic conditions, life cycle, and physical structure is called biome. I.e the biome is a small ecosystem within an ecosystem.

12. **What is meant by keystone species?**

Ans: Species which contribute to habitat functioning and without the work of these key species or when they disappears, the habitat change dramatically. Such species are called keystone species.

13. What are autotrophic and heterotrophic components? Give examples.

14. Define Biodiversity?

15. Define genetic and species diversity?

16. What do you understand by flora and fauna?

17. India is a mega diversity nation? Account.

Ans: India is one among the 12 mega diversity countries in the world.

It has 7.31% of world faunal species & 10.8%
of the world floral species. The loss of
biodiversity is about 33%.

18. What are the two important biodiversity hot spots in India?

19. Give few examples for endangered and endemic species of India?